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# Biomedical waste generation, composition and management: A case study of Shree Maharaja Gulab Singh Hospital (SMGS) Shalamar, Jammu (J&K)

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**Abstract**
For the life, health and general well-being, good medical care play vital role and hospitals are health institutions that provide these services. Wastes generated from the hospitals, medical care units, blood banks and medical laboratory is called biomedical waste. Proper management of biomedical waste is important for good health of not only the patients but also for residents living in the vicinity of hospitals. The present study, has been made to study biomedical waste management in SMGS Hospital Jammu (Jammu and Kashmir). The average biomedical waste per bed per day of SMGS Hospital was observed to be 116.37g, whereas maximum value of average biomedical waste per bed per day was observed to be 315.61g in Gynecology and Obstetric, 68.34g in ENT wards, 37.28g in Paedriatic wards and 44.27g in Dermatology wards The average per bed per day biomedical waste generation in SMGS hospital appears to be is less as compared with work of other workers because their evaluations were based on Biomedical Waste (Management and Handing) Rules, 1998 in which both infectious and non-infectious waste were included whereas present study was based on Bio-Medical Waste Management Rules which included only infectious waste.

**Keywords:** Biomedical waste, Gynecology, Hospital, Obstetric

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## INTRODUCTION

Biomedical waste is a potentially infectious waste generated from the medical and laboratory origin. Biomedical waste is defined as any waste which is generated during diagnosis, treatment immunization of human beings or animal or in research activities. MOEF, GOI, The Gazette of India (2016). The hospital waste can be classified into various categories like general non-hazardous that waste tincludes waste generated from sweeping, mapping, dusting, brooming of wards, paper pieces and waste paper; pathological waste consisting of tissues, organs, body parts, animal carcasses and mostly blood and body fluids; radioactive waste including solid, liquid and gaseous waste i.e. contaminated with radionuclides generated from in-vivo organs imaging and tumor localization and therapeutic procedure ;chemical waste comprising of discarded solid, liquid and gaseous chemicals e.g. from diagnostic and experimental work, housekeeping and disinfecting procedure and infectious waste. These are those waste which contain pathogens in sufficient concentration or quantity that posed huge risk to the health of the public, patients and professional therby contributing to environmental degradation. Narang *et al.* (2012). Government of India, Ministry of Environment, Forest and Climate Change on 28 March (2016) published the Bio-Medical Waste Management Rules, 2016 in the Gazette of India. Biomedical waste (Management and handling) rules, 2016 included four categories- Red, Yellow, White and Blue in which only infectious waste are present. MOEF, GOI, The Gazette of India (2016)

Medical and health care waste has sharply increased in recent decades due to increased population, number and size of health care facilities as well as use of disposable medical products. According to United States Environment Protection Agency (USEPA) (2011) medical waste contain all waste materials generated by health care facilities such as hospitals, clinics, physicians office dental practices, blood banks and veterinary hospitals/ clinics as well as at medical research facilities and laboratories including a wide range of materials such as used needles and syringes, dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices and radioactive materials. Hospital waste handling requires a high standard of training. Rastogi *et al.* (2011) reported that hospital waste is highly infectious and can be a critical problem to human health if not managed

properly, Biomedical waste (BMW) management requires its categorization as a first step. In present study, an attempt has been made to study biomedical waste management in SMGS Hospital Jammu, (J&K) comprising 750 beds.

## MATERIALS AND METHODS

The study area, Shree Maharaja Gulab Singh (SMGS) Hospital is located at Shalamar, Jammu (J&K). In this hospital, treatment is given to large number of local people. The hospital is divided into four blocks and the total number of beds were 750. Block 1 consists of Gynecology and Obstetrics, laborroom, female ward 1, 2,3,4,5 and the Recovery ward with total no. of 260 beds. Block 2 consist of Paediatrics Ward 19, 20, 21NICU A, B, C, Malnutrition ward, Thalassemia ward with total no. of 360beds. Block 3 consists of ENT Department with a no. of wards and ENT O.T. with total no. of 80 beds. Block 4 consists of Dermatology with a special male ward and special female ward with total no. of 50beds.

The study area was divided into four sites: Site 1: Gynecology and Obstetrics, Site 2: Paediatrics, Site 3: ENT Department, Site 4: Dermatology Department. The study was carried out in the period of Jan-April 2018 and during each sampling, hospital waste generated in Red bin, Yellow bin, White bin and Blue bin at different sites of hospital during 24 hours period was collected to observe qualitative and quantitative composition of waste in each bin at each site. For quantitative composition the waste was weighed using Single pan balance with accuracy of 1 mg. The average no. of patients per day was also recorded to calculate the average biomedical waste generation per/ patient per day. To monitor the biomedical waste management practices of hospital, time interval for removal of waste from each bin was also recorded.

## RESULTS AND DISCUSSION

The analysis of data revealed that the average generation of BMW per bed in labor room, Obstetricsand Gynecology ward in the Red Bin was observed to be 32.5g, 28.1g and 29.1g with average value of 29.91g per bed in Gynecology and Obstetrics site of the hospital. The total BMW generation in the red bin of gynae and obstetric site was calculated to be 7586.5g [per bed value 29.91* 260 (Total no. of bed).The average BMW generation in yellow bin was observed to be 787.3g, 12.1g and 12.1g per bed in labour room, obstetric and gynae respectively with an average per bed value of 270.5g. The total biomedical waste in yellow bin at this site was calculated to be 40355.6g [per bed value 270.5g*260 (Total no. of bed) BMW per day. The average. BMW generation per bed in laborroom, obstetric and gynae ward in the White Bin was observed to be 3.58g, 1.72g and 1.72g respectively with average value of 2.34g per bed in Gynecology and Obstetrics site of the hospital. The total BMW generation in the white bin of gynae and obstetric site was calculated to be 563.48g [per bed value 2.34* 260 (Total no. of bed).The average BMW generation in Blue bin of SMGS hospital was observed to be17.2g, 10.7g and 10.7g.per bed in labour room, obstetric and gynae respectively with an average per bed value of12.86g. This amount observed as 3094g [per bed value 12.86g*260 (Total no. of bed)] BMW per day in the yellow bin of this site (Table1).

The analysis of data further revealed that the average BMWgeneration per bed in ENT ward and operation theatre in the Red Bin was observed to be 22g and 33.8g respectively with average value of 27.9g per bed in Red bin of ENT site of the hospital. The total BMW generation in the red bin of ENT site was calculated to be 1929.5g [per bed value 27.9* 80 (Total no. of bed).The average BMW generation in yellow bin was observed to be 10.5g and 41.25g per bed in ENT ward and O.T respectively with an average per bed value of 25.87g. This amount observed as 1046.25g [per bed value 25.87g*80 (Total no. of bed)] per day in the yellow bin of this site. The average BMWgeneration per bed in ENT ward and O.T in the White Bin was observed to be 1.72g and 4.48g with average value of 3.1g per bed in thissite of the hospital. The total BMW generation in the white bin of ENT site was calculated to be 160g [per bed value 3.1* 80 (Total no. of bed).The average BMW generation in Blue bin was observed to be 12.6g and 10.35g per bed in ENT and O.T with an average per bed value of 11.47g. This waste amounted to be 1059.75g [per bed value 11.47g*80 (Total no. of bed)] in the yellow bin of this site (Table2).

The analysis of data revealed that the average BMWgeneration per bed in Paediatrics ward in the Red Bin was observed to be 22g with average value of 22g per bed at this site of the hospital. The total BMW generation in the red bin of Paediatrics site was calculated to be 7920g [per bed value 22* 360 (Total no. of bed). The average BMW generation in yellow bin was observed to be 10.5g per bed in Paediatrics ward with an average per bed value of 10.5g. This was amounted to be 3780g [per bed value 10.5g*360(Total no. of bed)] in the yellow bin of this site. The average generation of BMW per bed in Paediatricsward in the White Bin was observed to be 2.48g with average value of 2.48g per bed in thissite of the hospital. The total BMW generation in the white bin of this site was calculated to be 892.8g [per bed value 2.48* 360 (Total no. of bed). The average BMW generation in Blue bin was observed to be 2.3g per bed in Paediatrics ward with an average per bed value of2.3g. This was amounted to be 828g [per bed Paediatrics ward with an average

**Table 1.** Average Biomedical waste (Per bed per day) in Gynaecology and Obstetric of SMGS Hospital.

| Type of Bin/ Waste | Labour room (per bed Per day) | Total no. of beds (48) | Obstetric (per bed per day) | Total no. of beds (146) | Gynae (per beds per day) | Total no. of beds (66) | Average waste in atudy Area |
|---|---|---|---|---|---|---|---|
| RED | | | | | | | |
| Syringes | 8.8g | 422.4g | 5.6g | 817.6g | 5.6g | 369.6g | |
| Drip set | 3g | 144g | 5.25g | 766.5g | 5.25g | 346.5g | |
| Glucose | 7.15g | 343.2g | 8.45g | 1233.7g | 8.45g | 557.7g | |
| Catheter | 5.6g | 268.8g | 2.8g | 408.8g | 2.8g | 184.8g | |
| Gloves | 8g | 384g | 6g | 876g | 7g | 462.9g | |
| TOTAL | 32.55g | | 28.1g | | 29.1g | | 29.91g |
| YELLOW | | | | | | | |
| Cotton swabs | 11.2g | 537.6g | | | | | |
| Gauge | 22.8g | 1094.4g | 4.4g | 642.4g | 4.4g | 290.4g | |
| Blood bags | 3.3g | 158.4g | 6.6g | 963.6g | 6.6g | 435.6g | |
| Placenta | 750g | 36000g | 1.1g | 160.6g | 1.1g | 72.6g | |
| TOTAL | 787.3g | | 12.1g | | 12.1g | | 270.5g |
| WHITE | | | | | | | |
| Sharps(needle) | 0.88g | 42.24g | 0.52g | 75.92g | 0.5g | | |
| Blades | 0.9g | 43.2g | 0.3g | 43.8g | 0.3g | | |
| Scalpels | 1.8g | 86.4g | 0.9g | 131.4g | 0.9g | | |
| TOTAL | 3.58g | | 1.72g | | 1.72g | | 2.34g |
| BLUE | | | | | | | |
| Ampoules | 6.75g | 324g | 4.05g | 591.3g | 4.05g | 267.3g | |
| Vials | 10.45g | 501.6g | 6.65g | 970.9g | 6.65g | 438.9g | |
| TOTAL | 17.2g | | 10.7g | | 10.7g | | 12.86g |
| The average biomedical waste generated per bed per day in Gynecology and Obstetrics | | | | | | | 315.61g |

**Table 2.** Average Biomedical waste (Per bed per day) in ENT Department of SMGS Hospital.

| Type of bin/ waste | ENT Ward (per bed per day) | Total no. of beds (80) | ENT O.T. (per patient per day) | Total no. of patients per day(5) | Total study area |
|---|---|---|---|---|---|
| RED | | | | | |
| Syringes | 5.2g | 416g | 8.8g | 44g | |
| Gloves | 6g | 480g | 11g | 55g | |
| Drip set | 2.25g | 180g | 6.75g | 33.75g | |
| Glucose | 7.15g | 572g | 5.85g | 29.25g | |
| Catheter | 1.4g | 112g | 1.4g | 7g | |
| TOTAL | 22g | | 33.8g | | 27.9g |
| YELLOW | | | | | |
| Cotton swabs | 5.2g | 416g | 14.4g | 72g | |
| Cotton gauge | 4.2g | 336g | 21.6g | 108g | |
| Blood bags | 1.1g | 88g | 5.25g | 26.25g | |
| TOTAL | 10.5g | | 41.25g | | 25.87g |
| WHITE | | | | | |
| Sharps(needle) | 0.52g | 41.6g | 0.88g | 4.4g | |
| Blades | 0.3g | 24g | 0.9g | 4.5g | |
| Scalpels | 0.9g | 72g | 2.7g | 13.5g | |
| TOTAL | 1.72g | | 4.48g | | 3.1g |
| BLUE | | | | | |
| Ampoules | 6.3g | 504g | 4.05g | 20.25g | |
| Vials | 6.3g | 504g | 6.3g | 31.5g | |
| TOTAL | 12.6g | | 10.35g | | 11.47g |
| The average biomedical waste generated per bed per day in ENT Department | | | | | 68.34g |

per bed value of2.3g. This was amounted to be 828g [per value 2.3*360 (Total no. of bed)] in the yellow bin of this site (Table 3).

The analysis of data revealed that the average generation of BMW generation per bed in Dermatology ward in the Red Bin was observed to be 19.9g with average value of 19.9g per bed in this site of the hospital. The total BMW generation in the red bin of dermatology site was calculated to be 995g [per bed value 19.9* 50 (Total no. of bed).The average BMW generation in yellow bin was observed to be 10.5g per bed in dermatology ward with an average per bed value of10.5g. This was amounted to be 525g [per bed value 10.5g*50

**Table 3.** Average Biomedical waste in Pediatrics wards of SMGS Hospital.

| TYPE OF BIN/WASTE | WARDS [Per bed per day] | A*360 | TOTAL STUDY AREA |
|---|---|---|---|
| RED | | | |
| Syringes | 5.2g | 1872g | |
| Gloves | 6g | 2160g | |
| Drip set | 2.25g | 810g | |
| Glucose bottles | 7.15g | 2574g | |
| Catheter | 1.4g | 504g | |
| TOTAL | 22g | | 22g |
| YELLOW | | | |
| Cotton swabs | 5.2g | 1872g | |
| Cotton gauge | 4.2g | 1512g | |
| Blood bags | 1.1g | 396g | |
| TOTAL | 10.5g | | 10.5g |
| WHITE | | | |
| Sharps (needle) | 0.08g | 28.8g | |
| Blades | 0.6g | 216g | |
| Scalpels | 1.8g | 648g | |
| TOTAL | 2.48g | | 2.48g |
| BLUE | | | |
| Ampoules | 0.9g | 324g | |
| Vials | 1.4g | 504g | |
| TOTAL | 2.3g | | 2.3g |
| The average biomedical waste generated per bed per day in Paedriatic ward | | | 37.28g |

**Table 4.** Average Biomedical waste in Dermatology Wards of SMGS Hospital.

| TYPE OF BIN/ WASTE | DEMATOLOGY WARDS[ Per bed per day] | A*50 | TOTAL STUDY AREA |
|---|---|---|---|
| RED | | | |
| Syringes | 5.2g | 260g | |
| Gloves | 6.5g | 325g | |
| Drip set | 2.25g | 112.5g | |
| Glucose bottle | 4.55g | 227.5g | |
| Catheter | 1.4g | 70g | |
| TOTAL | 19.9g | | 19.9g |
| YELLOW | | | |
| Cotton swabs | 5.2g | 260g | |
| Cotton gauge | 4.2g | 210g | |
| Blood bags | 1.1g | 55g | |
| TOTAL | 10.5g | | 10.5g |
| WHITE | | | |
| Sharps(needle) | 0.52g | 26g | |
| Blades | 0.3g | 15g | |
| Scalpels | 0.9g | 45g | |
| TOTAL | 1.72g | | 1.72g |
| BLUE | | | |
| Ampoules | 5.85g | 292.5g | |
| Vials | 6.3g | 315g | |
| TOTAL | 12.15g | | 12.15g |
| average biomedical waste generated per bed per day in Dermatology ward | | | 44.27g |

(Total no. of bed)] in the yellow bin of this site. The average BMW generation per bed in dermatology ward in the White Bin was observed to be 1.72g with average value of 1.72g per bed in this site of the hospital. The total BMW generation in the white bin of this site was calculated to be 86g [per bed value 1.72* 50 (Total no. of bed). The average BMW generation in Blue bin was observed to be 12.15g per bed in dermatology ward with an average per bed value was 12.15g. This was calculated to be 607.5g [per bed value 12.15*50 (Total no. of bed)] BMW per day in the yellow bin of this site (Table 4). The average biomedical waste per bed per day of SMGS Hospital was observed to be 116.37g, whereas maximum value of average biomedical waste per bed per day was 315.61g in Gynecology and Obstrietric, 68.34g in ENT wards, 37.28g in Paedriatic wards and 44.27g in Dermatology wards.

The visual observation in the study area (SMGS

Hospital) revealed that inspite of –placement of different colored dustbins in the various sites of hospital, the disposal of waste in specific color bin was not done properly and the total waste generated was disposed off per day by JK Anmol Health Care unit. This company is registered under Registrar of Companies (RoC-Jammu) and it is classified as the Indian Non-Government Company. This manage medical waste with aims to treat and nullify the threats of Infectious BMW. Deshmukh and Rathod (2016) reported that biomedical waste is one of the biggest challenge of present day due to its direct impact on the health of the citizens.

Overall analysis of data revealed that on an average 116.37g (0.11637Kg) biomedical waste per bed per day is generated in SMGS hospital. This observation seems to be contradictory to work of Abah and Ohimain (2011), Agunwamba *et al* (2013) who reported hospital waste in the range of 0.5 Kg to 2.78 Kg. per bed day because they evaluated their data on the bases of Biomedical Waste (Management and Handing) Rules, 1998 in which both infectious and non-infectious waste were included and biomedical waste was divided into ten categories whereas present study was based on Bio-Medical Waste Management Rules (2016) which included only infectious waste and waste was divided into four categories only.

It is suggested that the management of biomedical Health staff as well as attendants of patients should be fully awared to Biomedical Waste Management Rules 2016. For the collection of waste from each color coding bin should be done separately without intermixing itand dust bin must be with lid. Color code bin should be kept at that place where maximum waste collection is possible. Gupta and Shantmann (2016) reported lack of knowledge regarding management of biomedical waste among health workers in Lucknow. Appropriate authorities should do effective implementation of rule by surprise visiting inspection and the accountability of each and every person involved in management of biomedical waste should be fixed. Good quality gloves and masks should be provided to collectos and manual handling of waste should be avoided to reduce the risk of infection by needle prick or injury.

## Conclusion

Overall observations revealed that Shree Maharaja Gulab Singh Hospital, Shalamar, Jammu(J&K) has adopted BMW rules 2016 .partially as for collection of biomedical waste The four colored dust bins as per BMW rules 2016 are used but diposing off wastes is not done properly due to lack of full awareness of health staff as well as attendants of patients. The present study has not been done earlier in Jammu and is the first case study of Biomedical waste management in SMGS Hospital Jammu (J&K) as per BMW rules 2016.

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